PROCEDURE FOR THE PREPARATION OF 0.08 SIMULATOR EXTERNAL STANDARD SOLUTION FOR USE WITH A BREATH TEST INSTRUMENT

Introduction:

The breath test instrument is equipped with a Guth Breath Alcohol Simulator. This device produces a predictable, known vapor concentration by passing air though a heated aqueous solution of known alcohol concentration.

Principle and Purpose

The simulator external standard solution is a water and ethanol mixture formulated to provide a standard ethanol vapor concentration when used in a breath alcohol simulator at 34 ± 0.2 degrees Centigrade, of between 0.072 and 0.088 grams of ethanol per 210 liters of air, inclusive. To allow for depletion of alcohol from the solution during its use, the target starting concentration is 0.082 g/210L.

The aqueous ethanol concentration is determined as follows. The water/air partition ratio at 34 degrees Centigrade is 2585.8 (Jones, 1983). The water/alcohol concentration required to produce a 0.082 g/210L of vapor equivalent, should be 0.101 g/100 mL. For convenience, the simulator solution batches are prepared in a 54L container, requiring 54.5 grams of ethanol. The density of absolute ethanol at room temperature is 0.79 gm/mL, therefore a volume of 69.1 mL of ethanol in 54L of water is required.

The preparation is carried out at room temperature.

The reference vapor concentration used is the average value of the solution concentration (rounded to four decimal places) divided by 1.23 (Jones 1983, Dubowski 1983) and rounded to four decimal places to give the alcohol concentration in grams per 210 liters of vapor.

Equipment:

Agilent (Hewlett Packard) 7694 Headspace Autosampler or equivalent
Agilent (Hewlett Packard) 6890 gas chromatograph; one equipped with a J&W DBALC1 megabore (0.53 mm) 30 meter capillary column and another system equipped with J&W DBALS2 megabore (0.53 mm) 30 meter capillary column. (For information on the columns, see Headspace Protocol)
Computer System equipped with HP GC Chem Station
Compressed gases; air, nitrogen, hydrogen
Autosampler vials
Cap Crimper
Hamilton Automatic Diluter
50mL volumetric flask, grade A
10mL, 5mL, 2mL, 1 mL volumetric pipette, grade A
1mL pipette
Mechanical mixer and stir rod
Calibrated 54L container

Approved:

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Barry K. Logan, PhD

Date:

5/27/2002

Glass or appropriate plastic 500mL containers and caps
Tamper evident Tape or tamper evident caps
plastic storage bottles

Reagents:

200 proof absolute ethanol (USP Grade)
Laboratory Grade water

Controls:

Commercially prepared controls are included in run.

Preparation:

1) Fill the 54L vessel to approximately 80% of the 54L mark with deionized water.

2) In a 1L flask, add approximately 900mL deionized water and using volumetric glassware, add precisely 69.1mL absolute ethanol into the flask. Stopper the flask and mix well by inverting several times and add the contents of the flask to the mixing vessel. Rinse the flask with approximately 1L deionized water and add this to the mixing vessel. Fill the mixing vessel to the 54L mark with deioinzed water. Mix the solution by applying mechanical mixing for a minimum of two hours.

3) Assign a batch number to the solution. The first two digits represent the year in which the solution was made, followed by sequential three digit numbering, beginning with 001. Therefore, the first batch of 2002 would be 02001.

4) Remove approximately 50 mL of the mixed solution for testing.

Certification:

1) An individual with a valid Blood Analyst Permit, authorized by the State Toxicologist, analyzes five separate aliquots of the simulator solution, by headspace gas chromatography.

2) Record the results of the testing in the solution certification database, including the date and the results of the contemporary external control.

3) A minimum of three (3) analysts must certify the solution prior to its certification.

4) The average of the results from all of the analysts are computed (rounded to four decimal places). The standard deviation and relative standard deviation (CV) on all results are computed. (Freedman er al., 1978).

5) The solution is acceptable for use and therefore certified if it meets the following criteria. The average solution concentration must be between 0.098 and 0.108g/100mL inclusive. The CV must be 5% or less.

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6) The reference vapor concentration is calculated by dividing the solution concentration by 1.23 and rounding to four decimal places.

7) A solution is valid for use for a period of one year following its preparation.

Packaging:

1) The solution is dispensed into 500mL glass or appropriate plastic bottles and capped, tightly.

2) Each bottle is labeled with the batch number and its expiration date.

3) The bottles are sealed with tamper evident tape. Alternatively, tamper evident caps may be used in lieu of regular caps with tamper evident tape.

4) Once the solution is certified, it may be provided to the BAC technicians for use with the breath test instruments.

References:

AW Jones, Determination of Liquid/Air Partition Coefficients for Dilute Solutions of Ethanol in Water, Whole Blood and Plasma. Journal of Analytical Toxicology, 7, 1983 pp 193-197.

K.M. Dubowski, Breath Alcohol Simulators: Scientific Basis and Actual Performance. Journal of Analytical Toxicology, 3, 1983 pp177-182
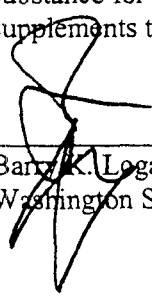
G.J. Shugar, R.A. Shugar and L. Bauman, Chemical Technicians Ready Reference Handbook. McGraw-Hill Book Co. 1978.

BAC Verifeer DataMaster Operator Instruction Manual, WSP Forensic Laboratories Services Bureau, May 1985, pp27-28.
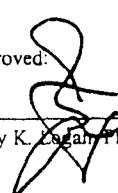
D. Freedman, R. Pisano and R. Purves, Statistics, W.W. Norton & Co. N.Y. 1978.

STATEMENT OF STATE TOXICOLOGIST – WSTX-BKL-1 05/24/02
In my capacity as Washington State Toxicologist, and by my authority outlined in RCW 46.61.506, I have reviewed this protocol and find it to be proper and adequate in form and substance for the purpose it was intended. I, therefore, approve and authorize its use. This supplements the simulator solution protocol dated 10/11/99, which remains in effect.

Barry K. Logan PhD.
Washington State Toxicologist

Approved:

Barry K. Logan PhD

Date:

5/27/2002